

AMENDED CLAIMS

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1. (Amended) A switching regulator converting an input voltage to a predetermined voltage and outputting the predetermined voltage to a load through an output terminal, comprising:

a first switching element including a first control electrode, said first switching element performing switching according to a control signal input to the first control electrode and controlling outputting the input voltage;

a second switching element including a second control electrode having capacitance larger than the capacitance of the first control electrode of the first switching element and an on-resistance smaller than the on-resistance of the first switching element, said second switching element performing switching according to a control signal input to the second control electrode and controlling outputting the input voltage;

a control switching circuit part performing one of a PWM control on both of the first switching element and the second switching element and a PFM control only on the second switching element according to an operating mode so that a voltage output from the output terminal is the predetermined voltage; and

a smoothing circuit smoothing a voltage output from

each of the first switching element and the second switching element and outputting the smoothed voltage to the output terminal, wherein said control switching circuit part performs said PWM control to increase the voltage from said output
5 terminal step by step from a predetermined first voltage to a second voltage when a first operating mode shifts into a second operating mode, and wherein in said first operating mode, said PFM control is performed and the output voltage from said output terminal is the predetermined first voltage, and in said second
10 operating mode, said PWM control is performed and the output voltage from said output terminal is the second voltage that is larger than the predetermined first voltage.

2. The switching regulator as claimed in claim 1,
15 wherein when shifting from the first operating mode to the second operating mode, said control switching circuit part switches from the PFM control to the PWM control where the output voltage from the output terminal is equal to the first voltage.

20 3. The switching regulator as claimed in claim 1, further comprising a dummy load in which a predetermined electric current flows, wherein said control switching circuit part connects said dummy load to the output terminal for a predetermined period when the output voltage from the output
25 terminal becomes equal to the second voltage.

4. (Amended) The switching regulator as claimed in claim 1, wherein said control switching circuit part comprises:

a PWM control circuit part performing the PWM control
5 on the first switching element;

a PFM control circuit part performing the PFM control
on the second switching element;

a switching circuit part controlling outputting
control signals from each of the PWM control circuit part and
10 the PFM control circuit part to the second control electrode
of the second switching element; and

a control circuit part controlling operations of the
PWM control circuit part, the PFM control circuit part and the
switching circuit part;

15 wherein in the first operating mode, the control
circuit part stops operations of the PWM control circuit part
and directs the switching circuit part to output the control
signal from the PFM control circuit part exclusively to the
second control electrode of the second switching element,

20 wherein in the second operating mode, the control
circuit part operates the PWM control circuit part and directs
the switching circuit part to output the control signal from
the PWM control circuit part exclusively to the second control
electrode of the second switching element, and

25 wherein the control circuit part increases the

output voltage stepwise progressively from the first voltage to the second voltage where the control circuit part stops the operations of the PFM control circuit part and directs the switching circuit part to output the control signal from the PWM control circuit part exclusively to the second control electrode of the second switching element when shifting from the first operating mode to the second operating mode.

5. The switching regulator as claimed in claim 4, further comprising a dummy load in which a predetermined electric current flows, wherein said control circuit part connects said dummy load to the output terminal for a predetermined period when the output voltage from the output terminal becomes equal to the second voltage.

6. The switching regulator as claimed in claim 1, wherein an electric current flowing into the load in the first operating mode is smaller than the electric current flowing into the load in the second operating mode.

7. (Amended) The switching regulator as claimed in claim 1, wherein the larger is the voltage difference between the first voltage and the second voltage, the more steps has said control switching circuit for increasing said output voltage step by step from the first voltage to the second voltage.

8. The switching regulator as claimed in claim 3, wherein the smoothing circuit part connected to the first switching element in series comprises a switching element for synchronous rectification, said switching element for
5 synchronous rectification being controlled by the control switching circuit when performing switching, and wherein the first switching element, the second switching element, the control switching circuit part, the switching element for
10 synchronous rectification and the dummy load are integrated into an IC.

9. (Amended) A method for switching an output voltage of a switching regulator with variable output voltage, said switching regulator comprising: an input terminal; an
15 output terminal; a first switching element including a first control electrode, said first switching element performing switching according to a control signal input to the first control electrode and controlling outputting an input voltage;
20 and a second switching element including a second control electrode having capacitance larger than the capacitance of the first control electrode of the first switching element and an on-resistance smaller than the on-resistance of the first
switching element, said second switching element performing
25 switching according to a control signal input to the second

control electrode and controlling outputting the input voltage, wherein said switching regulator is enabled to change the output voltage so as to convert the input voltage input from the input terminal into a predetermined voltage and to output the

5 predetermined voltage to the load via the output terminal by performing at least one of a PWM control on both of said first switching element and said second switching element and a PFM control only on said second switching element according to an operating mode, said method comprising the steps of:

10 performing said PWM control; and
increasing the voltage from the output terminal step by step from a predetermined first voltage to a second voltage when a first operating mode shifts into a second operating mode, wherein in said first operating mode, said PFM control is
15 performed and the output voltage from said output terminal is the predetermined first voltage, and in said second operating mode, said PWM control is performed and the output voltage from said output terminal is the second voltage that is larger than the predetermined first voltage.

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10. The method for switching the output voltage of the switching regulator as claimed in claim 9, said method further comprising a step of switching the PFM control to the PWM control in a state where the output voltage from the output
25 terminal is the first voltage when shifting the first operating

mode to the second operating mode.

11. The method for switching the output voltage of the switching regulator as claimed in claim 9, said switching
5 regulator further comprising a dummy load in which a predetermined electric current flows, said method further comprising a step of connecting said dummy load to the output terminal for a predetermined period when the output voltage from the output terminal becomes equal to the second voltage.

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12. The method for switching the output voltage of the switching regulator as claimed in claim 9, wherein an electric current flowing into the load in the first operating mode is smaller than the electric current flowing into the load
15 in the second operating mode.

13. (Amended) The method for switching the output voltage of the switching regulator as claimed in claim 9, wherein the larger is the voltage difference between the first
20 voltage and the second voltage, the more steps has said control switching circuit for increasing said output voltage step by step from the first voltage to the second voltage.